

What is claimed is:

1. An optical fiber for the transmission of optical energy, the optical fiber comprising:
 - a cladding region including a photonic band gap structure, the optical energy having a wavelength within the photonic band gap of the photonic band gap structure; and
 - a core region surrounded by the photonic band gap structure,wherein the photonic band gap fiber guides the optical energy substantially within the core region with a loss of less than about 300 dB/km.
2. The optical fiber of claim 1 wherein the optical energy has a wavelength between about 150 nm and about 11 μm .
3. The optical fiber of claim 1 wherein the core region has a lower effective refractive index than the average refractive index of the photonic band gap structure.
4. The optical fiber of claim 1 wherein the core region is composed substantially of a gaseous material.
5. The optical fiber of claim 1 wherein the optical energy has a wavelength greater than about 1000 nm.
6. The optical fiber of claim 1 wherein the photonic band gap fiber guides the optical energy substantially within the core region with a loss of less than about 200 dB/km.
7. The optical fiber of claim 1 wherein the photonic band gap fiber guides the optical energy substantially within the core region with a loss of less than about 50 dB/km.
8. The optical fiber of claim 1 wherein the photonic band gap fiber guides the optical energy substantially within the core region with a loss of less than about 20 dB/km.
9. The optical fiber of claim 8 wherein the optical energy has a wavelength between about 1400 nm and about 1500 nm.

10. The optical fiber of claim 8 wherein the optical energy has a wavelength between about 1680 and 1900 nm.
11. The optical fiber of claim 1 wherein the optical energy is guided in a mode having a nonlinear refractive index of less than about 10^{-18} cm²/W.
12. The optical fiber of claim 1 wherein the optical signal is guided in a mode having a nonlinear refractive index of less than about 5×10^{-19} cm²/W.
13. The optical fiber of claim 1 wherein the optical fiber is capable of supporting a temporal soliton having a peak power of greater than about 1 MW.
14. The optical fiber of claim 1 having a dispersion of greater than 20 ps/nm/km at a wavelength within the photonic band gap.
15. The optical fiber of claim 1 wherein the optical fiber is fabricated by a stack-and-draw method.
16. The optical fiber of claim 1 wherein the optical fiber supports at least two modes guided substantially within the core.
17. The optical fiber of claim 1 wherein the optical energy propagates in the optical fiber with a wavelength and propagation constant within the band gap of the photonic band gap structure.
18. The optical fiber of claim 1, wherein the core region has a maximum diameter less than about four times the pitch of the photonic band gap structure of the cladding region
19. An optical fiber for the transmission of optical energy, the optical fiber comprising:
 - a core region; and
 - a cladding region,

wherein the optical fiber guides the optical energy in a mode having a nonlinear refractive index of less than about $10^{-18} \text{ cm}^2/\text{W}$.

20. The optical fiber of claim 19 wherein the optical signal is guided in a mode having a nonlinear refractive index of less than about $5 \times 10^{-19} \text{ cm}^2/\text{W}$.

21. The optical fiber of claim 19 wherein the optical fiber is capable of supporting a temporal soliton having a peak power of greater than about 1 MW.

22. The optical fiber of claim 19 wherein the photonic band gap fiber guides the optical energy substantially within the core region with a loss of less than about 300 dB/km.

23. The optical fiber of claim 19 wherein the photonic band gap fiber guides the optical energy substantially within the core region with a loss of less than about 50 dB/km.

24. The optical fiber of claim 19, wherein the cladding region is formed from a photonic band gap structure, the soliton having a wavelength within the photonic band gap of the photonic band gap structure; and wherein the core region is surrounded by the photonic band gap structure.

25. An optical fiber comprising
a core region; and
a cladding region,

wherein the optical fiber is capable of supporting a temporal soliton having a peak power of greater than about 1 MW.

26. The optical fiber of claim 25, wherein the optical fiber is capable of supporting a temporal soliton having a peak power of greater than about 3 MW.

27. The optical fiber of claim 25, wherein the cladding region is formed from a photonic band gap structure, the soliton having a wavelength within the photonic band gap of the photonic band gap structure; and wherein the core region is surrounded by the photonic band gap structure.